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MSUS ACADEMY

NEWSLETTER

Anatomy of the cervical nerve roots

presented by
David Lorenzana

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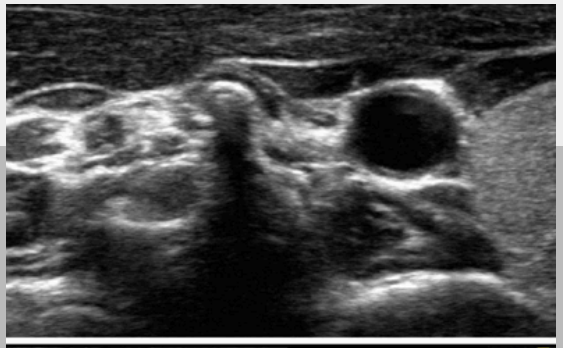
Article link

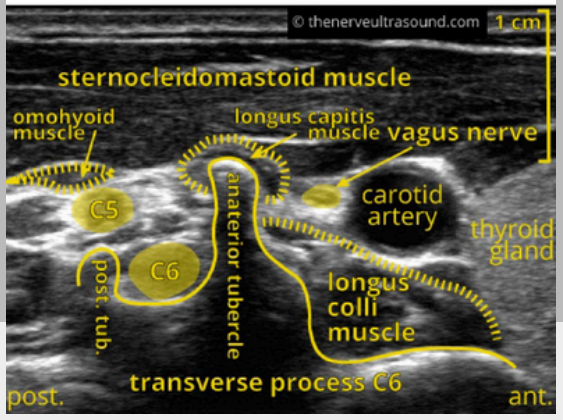
https://thenerveultrasound.com/

The cervical nerve roots exit the vertebral column via the foramen intervertebrale. As distinct from the thoracic, lumbar, and sacral levels, in the cervical spine the nerve root exits above the vertebral body of the corresponding level. So, the nerve root C4 passes the foramen intervertebrale formed by the transverse process of the cervical vertebral bodies 3 and 4. The cervical nerve roots C4 to C7 are usually clearly visible in ultrasound imaging. In patients with good ultrasound visibility, it is also possible to identify the nerve roots from the C3 to the C8 level. The first step is to identify the nerve roots. This is made possible by the characteristic aspect of the bony structures at each cervical level. For beginners, it can also be helpful to start with the palpation of the prominent anterior tubercle of the transverse process of the sixth vertebra at the level of the cricoid cartilage, starting the ultrasound scan at this level.

KEY POINTS

- The cervical region has a complicated neurovascular network and familiarization with the regional sonoanatomy is the basis before proceeding to ultrasound (US)-guided injections.
- The in-plane technique with visualization of the whole needle should be preferred for the injection of cervical nerves.
- Comprehensive understanding of the cervical sonoanatomy should remain as the prereq-uisite before one can plan US-guided cervical interventions.





Interview with
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MSUS Academy: You wrote the article “Ultrasound – a revolution in pain therapy” about ten years ago. What is the role of ultrasonography in pain therapy today? DOI: 10.1024/0040-5930/a000914

DL: Over the past decade, ultrasound has become a commonly used modality for needle guidance in pain therapy interventions on peripheral nerves and musculoskeletal structures. In contrast, for procedures in the cervical spine—such as medial branch blocks for facet joint disorders or periradicular infiltrations at the cervical nerve roots—many pain specialists still appear to prefer fluoroscopic or CT guidance.

From my perspective, ultrasonography offers relevant advantages in this anatomically sensitive region. Beyond eliminating radiation exposure, ultrasound enables detailed, real-time visualisation of individual soft-tissue anatomy, including small vessels and nerves. With adequate training and experience, this allows procedural risks to be minimised while improving precision and overall intervention quality. Nevertheless, ultrasound-guided cervical spine interventions require a high level of expertise, extensive training, and meticulous needle control, which may discourage some practitioners. Despite these challenges, ultrasound use in cervical pain interventions is likely to expand as future generations of pain physicians are increasingly trained in ultrasound during medical school.

Another important application of ultrasound in pain therapy is diagnostic nerve ultrasound. In my view, it is indispensable, particularly in the assessment of postoperative neuropathic pain. Although I have been lecturing and organising courses on this topic for more than a decade and interest has grown steadily, diagnostic nerve ultrasound remains significantly underutilised in pain medicine.

MSUS Academy: Can you highlight the diagnostic use of ultrasound for patients with neuropathic pain? DOI: 10.1016/j.jclinane.2023.111314

DL: Neuropathic pain resulting from peripheral nerve damage is a common clinical problem. The underlying causes are diverse and include nerve entrapment, traumatic or iatrogenic injury, tumours arising from the nerve itself or adjacent tissues, as well as irritation from foreign material or postoperative scar tissue. Provided the nerve is accessible to ultrasound— i.e. not obscured by bone or air —these pathological changes can often be directly visualised and assessed by ultrasound.

In particular, injury to small cutaneous nerves during surgery is a frequent cause of postoperative neuropathic pain. High-frequency ultrasound allows detailed, high-resolution imaging of these superficial nerves. For such structures, and for nerves located adjacent to implanted osteosynthesis material, ultrasound is clearly superior to MRI.

Identifying the precise structural cause of neuropathic pain is often a prerequisite for targeted interventional treatment. For this reason, diagnostic nerve ultrasound plays a central role in my evaluation of patients with neuropathic pain. However, its diagnostic value depends not only on image quality but, above all, on the examiner’s expertise. Profound anatomical knowledge—particularly of nerve pathways and their anatomical variability—combined with extensive hands-on experience, is essential for reliable interpretation.

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MSUS Academy: Is there a preferred drug you use? What about PRP in pain medicine?
DL: As my clinical focus is primarily on neuropathic pain, ultrasound diagnostics are usually followed by an ultrasound-guided diagnostic block of the suspected nerve or nerve branch. This step helps confirm the diagnosis and assess whether targeted nerve interventions are likely to influence the patient's symptoms. Consequently, local anaesthetics are my main drug. For small nerves, I typically use 0.5–1 ml of 0.5% ropivacaine.
If I suspect nerve irritation due to scar tissue or impaired nerve gliding in the surrounding tissues, I prefer either a lower-concentration local anaesthetic or 5% glucose for perineural hydrodissection. In cases of clearly defined entrapment syndromes with corresponding sonographic findings—such as meralgia paraesthetica or carpal tunnel syndrome— Following confirmation by a diagnostic block, I may inject corticosteroids around the nerve. This is the only situation in which I use steroids on peripheral nerves.
Beyond non-pharmacological approaches, including neuromodulation with implanted peripheral electrodes, I believe there is significant potential in perineural botulinum toxin for achieving longer-lasting peripheral nerve blockade. Although still an experimental off-label application, I use this approach regularly in selected patients with neuropathic pain.
My experience with platelet-rich plasma (PRP) is more limited. In my practice, PRP is mainly used for painful muscle and tendon insertions, although I see great potential for its use in pain medicine. I am particularly interested in perineural PRP applications for nerve injuries, although high-quality clinical evidence for this indication remains limited. A major limitation in Switzerland is that PRP treatment is not covered by health or accident insurance, making it feasible only for patients who are able to self-fund the therapy.

MSUS Academy: Finally, do you have any advice for young colleagues in training using musculoskeletal ultrasound?
DL: Practice, practice, practice. Competence in ultrasound starts with precise anatomical knowledge. From there, the key challenge is translating two-dimensional ultrasound images into a three-dimensional understanding of each patient's individual anatomy. Achieving this requires extensive and continuous hands-on experience.
Young colleagues should take every opportunity to practice scanning—both during formal courses and in daily clinical practice, on patients, colleagues, and even themselves. Once a basic level of competence has been achieved, I strongly recommend attending interdisciplinary ultrasound courses. Different medical specialties often approach ultrasound from slightly different perspectives, and this can significantly broaden one's own skills and understanding.
Finally, learning ultrasound is an ongoing process. There is always room to improve, and continuously refining one's skills is an essential part of professional development.

MSUS
Publication of the month

Link

Ultrasound evaluation of radial nerve injuries by cortex overlapping screw tips after internal fixation of humeral fractures.

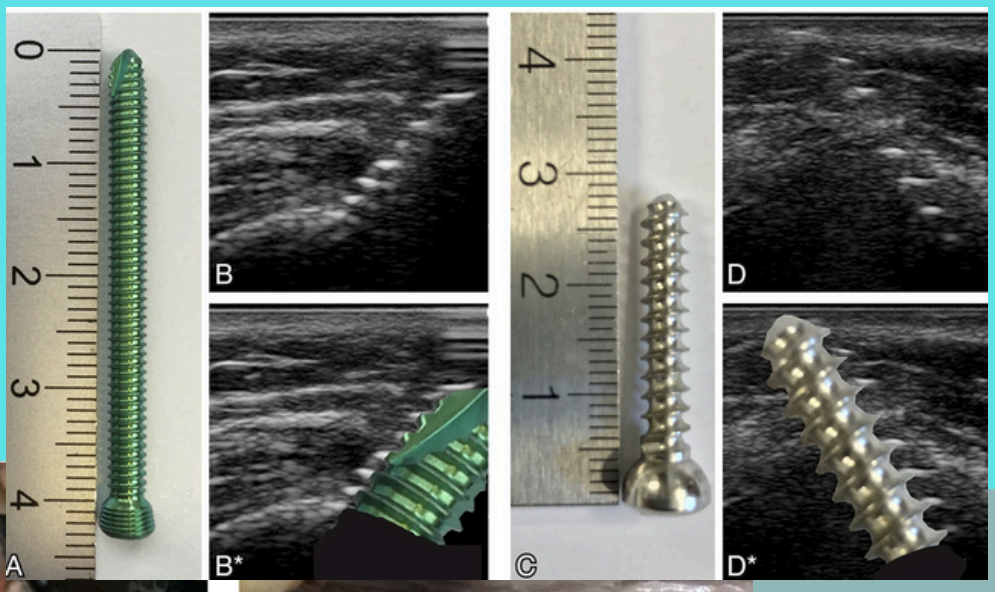
Abstract

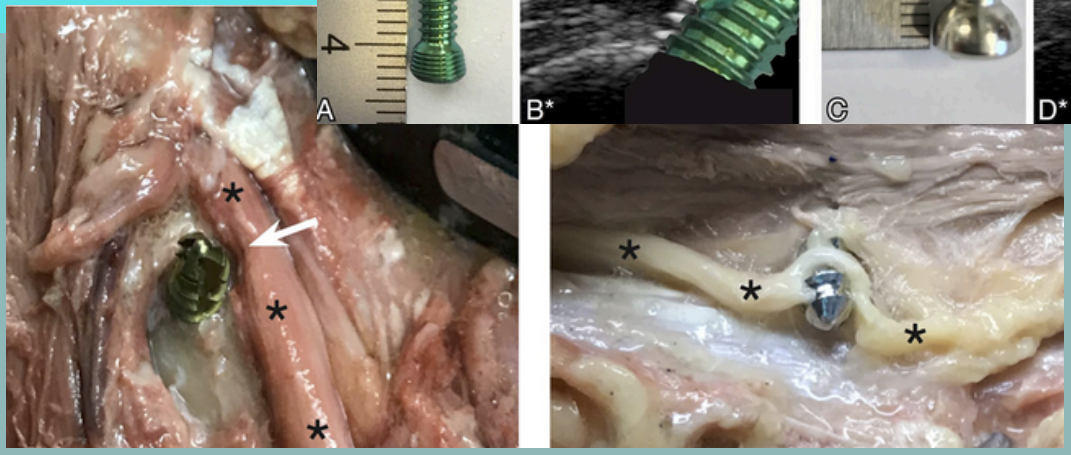
Purpose The radial nerve may be painfully irritated or damaged by open reduction and internal fixation (ORIF) of humeral fractures. Secondary radial nerve lesions after ORIF of humeral shaft fractures are described in up to 16%. Not only peripheral nerves but also orthopaedic instruments and osteosynthesis material are well visible by ultrasound. The aim of this study was to evaluate the accuracy of ultrasound in assessing the relation between the bone overlapping screw tips and the radial nerve close to the humeral bone.

Methods Ultrasound-guided drilling was used to place screws as close as possible to the radial nerve in 8 humeral bones of four cadavers. The relation between the radial nerve and the screw tips was assessed by high-resolution ultrasound, and the overlap of all screw tips over the bone was measured by ultrasound and fluoroscopy. Thereafter, the findings were validated by anatomical dissection.

Results We could correctly identify all screw tips and their relation to the radial nerve by ultrasound. In 7 of 8 cases, the screw tip had direct contact with the radial nerve. The overlaying length of the screw tip was accurately measured by using ultrasound in all cases. In contrast fluoroscopy underestimated this length in 50% of cases.

Conclusion With this study, we show that ultrasound can reliable visualize the screw tips and its relation to the radial nerve. Ultrasound is a promising diagnostic tool to evaluate patients with radial nerve irritations or lesions after ORIF of humeral fractures. Furthermore, ultrasound could be an adequate tool to guide drilling.





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